Geophysical Research Abstracts, Vol. 9, 10220, 2007
SRef-ID: 1607-7962/gra/EGU2007-A-10220
© European Geosciences Union 2007

The importance of discontinuous deformation in the eastern Sudbury Igneous Complex, Canada.

D. Doman and U. Riller

Museum of Natural History, Humboldt-University of Berlin, Germany
(daniel.doman@museum.hu-berlin.de), (ulrich.riller@museum.hu-berlin.de)

The 1.85 Ga Sudbury Igneous Complex (SIC) in central Ontario is now widely considered to be the erosional remnant of a deformed paleo-horizontal impact melt sheet. Deformed impact melt breccias of the Onaping Formation and post-impact metasedimentary rocks overlie the layered SIC, which in turn rests on shock-metamorphosed Archean and Paleoproterozoic country rocks. Previous workers considered non-cylindrical folding and NW-directed reverse faulting as the main structural processes that formed the asymmetric syn-formal geometry of the SIC apparent today. Structural studies support this model in the southern part of the impact structure, where greenschist-facies metamorphic tectonites accomplished structural uplift of the southern SIC by NW-directed reverse shearing. However, little evidence for fold-induced strain has been reported from the weakly metamorphosed eastern part of the SIC, characterised by steep basal dips and strong curvature in plan view. The objective of this study is to assess the structural inventory of the NW-SE trending eastern SIC, the East Range, in terms of post-emplacement deformation mechanisms.

Planar and linear mineral shape fabrics of euhedral plagioclase and pyroxene are observed in the intermediate gabbroic and lower noritic layers of the East Range SIC. Microstructures show that plagioclase minerals retained an angular outline indicating magmatic mineral fabric development. The magmatic foliations are concordant to SIC basal contact orientations. A weak metamorphic foliation is developed within the uppermost granophyric SIC of the NE-lobe that connects the SIC's North and East Ranges in an 80˚ arc. Microstructures show that the foliation is formed by an anastomosing network of chlorite- and calcite-filled fractures accompanied by intracrystalline deformation of quartz, indicating deformation under low-grade metamorphic conditions. Apart from this foliation, the East Range SIC and it's underlying

granitic host rocks are free of pervasive post-impact ductile strain fabrics. Kilometre-scale faults striking N-S cut the northern East Range and caused minor strike separations of SIC contacts. Localised strain fabrics, i.e., centimetre- to metre-scale narrow shear zones and chlorite-filled brittle shear-fractures, are observed within the East Range SIC and it's host rocks but do not form pervasive outcrop-scale networks.

The concordance of magmatic mineral shape fabrics with basal SIC contacts in the East Range may indicate a paleo-horizontal emplacement of the SIC required by impact models. However, the occurrence of linear magmatic shape fabrics hampers a confident interpretation of magmatic fabrics as cumulate layering. Foliations in the NE-lobe's granophyric SIC are concordant to greenschist-metamorphic foliations in the overlying Onaping Formation. Both foliations are concordant to the NE-lobe's bisector plane and, thus, indicate buckling of the SIC-Onaping Formation contact associated with the formation of the NE-lobe. In contrast to the Onaping Formation the SIC and it's underlying granitic host rocks consist of a coarse-grained, feldspar-rich load-bearing framework that deformed by cataclastic rather than mineral-plastic deformation under low-grade metamorphic conditions. Maximum principal shortening directions inferred from inversion of fault-slip data collected in the NE-lobe SIC and its host rocks are orthogonal to metamorphic foliation surfaces in the Onaping Formation breccias. This points to a similar deformation regime during ductile and brittle deformation. Thus, the observed ductile and brittle strain fabrics are compatible with a common deformation of the SIC and its host rocks. Additional information, including the subsurface geometry of faults and magnitudes of strain accommodated on them is needed to assess whether brittle deformation can accommodate rotation of the now steeply dipping East Range SIC from an initially horizontal orientation.